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ANNUAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

By Professor EDWIN G. CONKLIN

VICE-PRESIDENT AND EXECUTIVE OFFICER; PROFESSOR EMERITUS OF BIOLOGY,
PRINCETON UNIVERSITY

THE American Philosophical Society held its annual meeting in its hall on Independence Square, Philadelphia, on Thursday, Friday and Saturday, April 24, 25, 26. The annual meeting of the council was held on the afternoon and evening preceding the session on Thursday. This was an innovation intended to give more time to the important work of the council than was possible heretofore when it met only at dinner on the evening preceding the executive session. President and Mrs. Morris entertained the council at dinner, which was given this time in the society's hall.

The program on Thursday morning and afternoon included thirteen papers in the physical and biological sciences, abstracts of which are printed below. On Thursday evening, Dr. Hugh S. Taylor, professor of

chemistry at Princeton University, gave the Franklin Medal Lecture on "Large Molecules through Atomic Spectacles." The lecture was illustrated by models, slides and moving pictures showing novel conceptions of the structure of large molecules. The Benjamin Franklin Medal of the society was presented to Professor Taylor at the close of his lecture.

In the old days congenial members of this society used to adjourn to a Rathskeller or beer garden after an evening lecture, where light refreshment and light or heavy discourse were in order. These aftermath meetings were often most profitable and enjoyable. With the thought of reviving as far as possible this custom, round table parties were held in the hall of the society following Professor Taylor's lecture and

the opinion was generally expressed that they were both pleasant and profitable and should be continued.

The annual business meeting of the society was held on Friday morning at which the report of the president was presented, the proceedings of the council submitted and approved, reports of the committees on finance, research, publications and library received, and new appointments to committees announced. Report of the organizing committee on education and participation in science (adult education) was presented and its continuation recommended.

Officers, councillors and members were elected as given in the issue of *SCIENCE* for May 2.

Following the business meeting the open session was devoted to a general program on "Recent Advances in Psychology." J. McKeen Cattell, the Nestor of American psychologists, presided.

On Friday evening the program on psychology was concluded with the Penrose Memorial Lecture of Dr. Edward C. Tolman, professor of psychology, University of California, entitled "Motivation, Learning and Adjustment." This lecture was followed by a reception.

On Saturday morning five papers on archeological and historical subjects were presented. Saturday afternoon was assigned to an excursion to Valley Forge and its many historic monuments, and to a visit to the Cook Observatory at Wynnewood, where Mrs. Gustavus Wynne Cook graciously received the members and guests.

Luncheons were served each day of the meeting in the Hall of the Society, and the annual dinner was held on Saturday evening at the Bellevue Stratford Hotel, about two hundred members and invited guests being present. The John F. Lewis Prize of \$300.00 and diploma for an important work that had been reported to the society and published in its journal, was awarded to Dr. George Howard Parker, professor emeritus of zoology, Harvard University, for his work on Neurohumors as Activating Agents. The citation was made by Dr. Detlev W. Bronk, professor of physiology, Cornell University Medical College, and Dr. Parker replied briefly. Harold C. Urey, professor of chemistry, Columbia University, then spoke on Rapid Changes in the Chemical Substances of the Human Body. He was followed by Frank Aydelotte, director of the Institute for Advanced Study, Princeton, who spoke on The Internationalism of Learning and the recent gift of \$10,000 from the American Philosophical Society to the Royal Society of London for the promotion of science in Britain, and the exercises of the evening were brought to a happy close by an address from our long-time vice-president, Dr. Robert A. Millikan, director, Norman Bridge Laboratory of Physics, California Institute of Technology, on

The Democracy of Science and the Duty of Scientists in This World Crisis.

Abstracts of papers presented at the various sessions follow.

Long enduring meteor trains: CHARLES P. OLIVIER.

Recent studies of cosmic rays at high altitudes: ARTHUR H. COMPTON. Our recent high altitude studies of cosmic rays have been concerned chiefly with the production of mesotrons. Photographs using a cloud chamber between the poles of a large, permanent magnet have been obtained in an airplane by G. Herzog and W. Bostick. These photographs show an abundance of slow mesotrons, which are exceedingly rare at ground level. We observe also the production of positive and negative pairs of slow electrons of roughly equal energy. Using counter tube assemblies carried in airplanes and by balloons, V. C. Wilson, W. P. Jesse, M. Schein and E. O. Wollan have observed the number of mesotrons and their rate of production by neutral rays at various altitudes. The rate of production is inappreciable below 6,000 meters, becomes strong at 9,000 meters, and continues to increase up to at least 20,000 meters. At the highest altitude, where the barometer is 2 cm of mercury, the number of mesotrons is at least as great as the number of incoming cosmic ray particles as estimated by Millikan and his collaborators. The possibility that the particles entering the atmosphere can be electrons seems to be eliminated by experiments measuring at high altitudes the number of particles capable of penetrating thick blocks of lead. It is observed that close to the surface of the atmosphere most of the particles which traverse 4 cm of lead are capable of penetrating 18 cm. This would not be true if they were electrons with the lower energy limit required for passing through the earth's magnetic field, for such electrons should be stopped by about 10 cm of lead. The results are, however, in accord with the view that the primaries are protons which are themselves capable of traversing the lead, or which on striking the nuclei of atoms in the air spend their energy in producing penetrating mesotrons or mesotron pairs.

Crystalline diphtheria antitoxin: JOHN H. NORTHROP. Diphtheria toxin forms a precipitate when mixed in certain proportions with serum from a horse which has been immunized against the toxin. This precipitate is a compound of the toxin and antitoxin. The compound is dissolved in slightly acid solution and the toxin digested by trypsin. The antitoxin remains in solution. About 30 to 60 per cent. of the original antitoxin may be recovered in this way. This "crude antitoxin" may be further separated by precipitation with ammonium sulfate at about pH 7.2 into three fractions. The fraction soluble in 0.35 saturated ammonium sulfate but insoluble in 0.65 saturated ammonium sulfate has a high antitoxic titre (700,000-1,000,000) antitoxin units per gram protein nitrogen 90 per cent. or more of the protein is precipitated by diphtheria toxin. It is strictly homogeneous in the ultracentrifuge with a sedimentation constant of 5.7×10^{-13} . It shows only one boundary at pH 7.3 in the electrophoresis cell but there is some reversible spreading.

This fraction corresponds probably to the highly purified preparations of Pope and of Pappenheimer and their collaborators. Solubility determinations show that this fraction is still quite inhomogeneous. Extraction of this fraction with 0.5 saturated ammonium sulfate at pH 7.2 yields a small amount of a protein which has constant solubility and is therefore probably a pure protein. This protein crystallizes readily in the form of poorly formed thin plates. The antitoxic value is unchanged after three recrystallizations. The protein is quite unstable under all conditions so far found.

On some reactions of tobacco mosaic virus: W. M. STANLEY. The most important reaction of tobacco mosaic virus is the one which results in virus reproduction, for it provides the basis for virus activity. Slight variations in this reaction appear to be responsible for the appearance of new virus strains which become apparent through the new diseases they cause. With the isolation of tobacco mosaic virus in the form of a reasonably homogeneous crystalline nucleoprotein, it became possible to study other reactions of this material and to determine the effect of such reactions on the basic reaction of virus activity. It was found that formaldehyde reacts with the amino groups and probably the indole nuclei of tobacco mosaic virus and causes loss of virus activity. With Dr. Miller, it has been demonstrated that most of the amino groups may be acetylated without interference with the basic reaction, hence it appears likely that the formaldehyde inactivation is not due to coverage of amino groups. In the present work it has been found that phenyl isocyanate reacts with tobacco mosaic virus and that about 3,000 phenylureido groups may be introduced into a single molecule of virus. The fact that the phenylureido derivative migrates as a single component in an electrical field indicates that approximately the same number of groups were introduced into each molecule of virus. The electrophoretic mobility of the derivative differs from that of untreated virus, and mixtures of the two can be separated readily. As expected, the sedimentation constant of the phenylureido derivative is essentially the same as that of the untreated virus. Antiserum to the phenylureido derivative gives a precipitin reaction with the derivative as well as with untreated virus. Electron micrographs prepared by Dr. Anderson and showing the reaction between tobacco mosaic virus and its rabbit antiserum will be presented. The introduction of the phenylureido groups was not found to affect the specific virus activity, and in a single experiment the virus isolated from plants inoculated with the derivative was found to have the normal value for amino nitrogen. This indicates that the alteration of the virus is not perpetuated in subsequent generations and, hence, that a large portion of the surface structure of the virus may be changed without interfering with the basic reaction of virus reproduction.

Quantum effects in evolution: GEORGE GAYLORD SIMPSON. Stability in a natural population of animals requires equilibrium of their genetics, structure and environment. A quantum effect in evolution is defined as the rapid transition from one equilibrium to another separated from

the first by a definite span in which the population is or would be unstable and unadaptive. Paleontological data reveal apparent quantum effects that can surely be interpreted as mere deficiencies of record. There are, however, other and usually larger gaps in the record that are systematic and that coincide with major changes of adaptive level. Analysis shows that evolution during these changes must have been much more rapid than at other times, but that instantaneous change from one adaptive type to the other is improbable if not impossible. Analogous accelerations of rate on a smaller scale are demonstrated within recorded phyla. These provide concrete examples of effects postulated in recent work on population genetics, and they reveal the mechanism involved in minor quantum effects. The still greater rapidity of major quantum shifts theoretically requires that the populations concerned be smaller and more isolated. Their otherwise anomalously poor representation in the fossil record is thus to be expected and corroborates this theory, with which the positive features of the record also agree. There are three major modes of evolution: (1) speciation, typically by segregation of genetic variation stored in a population, as stressed by most geneticists, (2) phyletic evolution, typically by relatively slow and usually linear secular shifts of populations, as hitherto stressed by most paleontologists, and (3) quantum evolution as here defined and exemplified. The total pattern of evolution is a complex combination of these three modes.

New light on the origin of the Carolina "Bays": DOUGLAS JOHNSON. In a previous discussion before the Philosophical Society, evidence was presented to show that the supposed meteorite scars of the Carolina coast had been produced by normal terrestrial agents. The present discussion briefly reviews the hypothesis that the supposed "scars" are produced by artesian spring excavation accompanied by solution resulting in the formation of basins occupied by lakes, the waves of which built beach ridges about the borders of the depressions while dominant winds drifted sand to form the rims earlier attributed to meteoric excavation. Aerial photographs recently made available contribute new evidence in support of this hypothesis.

The Oligocene Mammalia of the White River: WILLIAM B. SCOTT.

Certain aspects of induced ovulation in the opossum: OLIN E. NELSEN. Ovulation may be induced in the opossum during the period of sexual rest or anoestrus by treatment with the follicle stimulating and luteinizing factors of the anterior lobe of the pituitary body. Luteinizing hormone derived from pregnancy urine appears to be equally effective when substituted for the luteinizing hormone of the pituitary body. A series of injections of the follicle stimulating factor (FSH) is given to stimulate follicular growth, followed by another series, to effect ovulation, of the follicle stimulating factor plus the luteinizing factor (LH). All injections are given subcutaneously. During the active reproductive period, with its recurrent oestrous cycles, the

induction of ovulation is more complicated. The FSH injections which stimulate follicular development, followed by the ovulating doses of FSH plus LH in combination, works well if applied during the dioestrous interval or during early prooestrus. Ovulation may be induced, however, by the combination of FSH plus LH alone, without the previous injections of follicle stimulating hormone (FSH) providing the injections are begun toward the end of prooestrus or at the onset of oestrus. To induce ovulation during the active sexual period, it is necessary, therefore, to know the actual stage of the oestrous cycle through which the animal is passing in order that the introduced hormones may be correlated with the natural cyclic changes. This information is gained by a careful study of the vaginal smear at the time the injections are begun and during the course of the injections.

Limited responses of melanophores as determined by activating agents. G. H. PARKER. In the skin of a pale catfish the large melanophores are represented by black spheres some 45 microns in diameter. In a fully dark catfish each such melanophore covers an area with a diameter of some 145 microns. The concentrated state of the melanophores is induced through nerve fibers that presumably discharge adrenaline (adrenergic fibers). The dispersed state is induced through either nerve fibers that probably discharge acetylcholine (cholinergic fibers) or through intermedine carried from the pituitary gland of the brain by the blood to the melanophores. If the pituitary gland is removed from a catfish, this fish can still darken but only partly (each melanophore can disperse its pigment to cover an area whose diameter is at most about 100 microns). This reaction must depend exclusively upon cholinergic fibers (acetylcholine). When additional acetylcholine is injected into such a fish, the melanophore pigment is not further dispersed. This is true even when enough acetylcholine is injected to kill the fish. If into such a partly darkened fish a small amount of intermedine is injected, the fish will then fully darken. Intermedine, if injected into a pale fish, will also completely darken it. Hence acetylcholine as compared with intermedine is capable of inducing only a limited and well-defined dispersion of pigment in catfish melanophores. The blanching agent adrenaline shows no such limitation in its action. It is noteworthy that acetylcholine in large doses is deadly to catfishes, but intermedine is not. What restricts the action of acetylcholine on the melanophores of this fish is not known. When under natural conditions a fish darkens, its melanophores are first excited through nerves (acetylcholine) and only subsequently does intermedine become an effective agent.

Self-sculpturing of bone: CHARLES B. DAVENPORT. The long bones of the palm of the hand and of the fingers have a nearly cylindrical column in the middle and a flaring head at each end. To the head are attached muscles for moving the fingers. In a child these long bones grow rapidly in length but only at the broad terminal surfaces. In this process the broad head as it is at any moment is immediately left behind and becomes incorporated in the slender column while new material is formed at the broad

surface of the advancing head. This involves the absorption of the margins of the left behind part of the head and reconstruction of this part of the bone into part of the column. The ends of the finger muscles which are attached to the periosteum covering the head apparently move constantly to new positions as the new material advances. The resculpturing of the ends of the bones is beautifully and accurately done so that ordinarily no trace of the old head appears in the elongating shaft. In identical twins the sculpturing is done so accurately that exceedingly similar outlines of the bones of the hand result.

New mutational segregations from Oenothera mut. Erythrina de Vries: GEORGE H. SHULL. *Oe. mut. erythrina de Vries*, when selfed, is known to produce in every progeny two types, one repeating the parent, the other a new type, seg. *decipiens*, which breeds true when selfed because it lacks both of the balanced lethals which characterize *Oe. Lamarckiana*. *Erythrina* splits in this way because it has only one of the *Lamarckiana* lethals. Some years ago I reported the occurrence of a new mutational segregation in which mut. *pollicata* was found to characterize the *decipiens* component of such a splitting progeny, while normal hypanthium, styles and stigmas characterized the *erythrina* component. A continuation of studies with *erythrina* have brought to light a number of new segregations, sometimes replacing *decipiens*, in other cases being additional to *decipiens*. The first of these new mutational segregates was discovered on March 8, 1935, when family 3485, produced from a self-fertilized *erythrina* mother, was observed to split out 45 plants of a peculiar new type afterwards called seg. *petiolaris*, in a total progeny of 164. A complete analysis of this family showed it to consist of 70 *erythrina*, like the parent, 50 seg. *decipiens*, 43 seg. *petiolaris*, and 1 unidentified mutant. Over half of the *erythrina* plants in such a family repeat the three-way split when selfed, while the rest split only to *erythrina* and *decipiens*. On March 20, 1938, another remarkable new segregation, seg. *contracta*, was discovered in family 37428, derived from an *erythrina* mother in this same strain. The unique feature this time was not alone the remarkable modification represented by the new type itself, but seg. *contracta* replaces seg. *decipiens*. Family 37428 consisted of 61 *erythrina* and 40 *contracta*, no *decipiens* being present. Every *erythrina* plant in such a family produced the same kind of a family, consisting of *erythrina* and *contracta*. In 1939 another new segregate, seg. *diminua*, was found, and in 1940, still another, seg. *cyanea*, was added to a *contracta*-segregating family (39533) which split to 61 *erythrina*, 25 *contracta*, 16 *cyanea*. In 1941 one family (40110) from selfed *erythrina* has had the *decipiens* segregate replaced by seg. *elongata* and in another progeny (40130) seg. *retracta* has replaced seg. *contracta*. An essentially true-breeding *erythrina* has resulted when seg. *decipiens* is replaced by seg. *sublethalis*, the latter being rarely seen because it has so little chlorophyll that usually it does not live beyond the germination stage. This "non-splitting" *erythrina* was discovered in 1938 in family 37411, but seg. *sublethalis* was not observed until the current year (1941).

The mechanism and probable significance of the convulsions produced by cyanide: CARL F. SCHMIDT. In a series of earlier experiments in this laboratory, generalized convulsions were sometimes elicited in cats and dogs by reduction in the oxygen tension of, or by addition of cyanide to, the fluid used to perfuse the carotid bodies. The possibility, suggested by those experiments, that reflexes from the carotid and aortic chemoreceptors can set up in the central nervous system an excitation sufficiently powerful and widespread to lead to convulsions, has now been tested under conditions more closely approximating the normal by determining the influence of aseptic denervation of the carotid and aortic reflex zones on the convulsions elicited in dogs by intravenous injection of sodium cyanide (about 1 mgm per kilogram). In intact animals these convulsions were regularly produced, epileptiform in character, associated with complete unconsciousness, and followed by profound weakness and depression; alkalosis resulting from the vigorous hyperpnea which preceded the convulsions was not responsible for the latter because they also occurred when the animals were made to breathe air enriched with carbon dioxide. In one dog carotid denervation sufficed to render cyanide entirely ineffective: there were no traces of convulsions, consciousness was retained, and no visible weakness or depression ensued. In another, an identical result was obtained, but only after denervation of both aortic and carotid regions. In a third, convulsions were still elicited by cyanide after complete denervation of carotids and aorta. The situation therefore is not simple, but it seems clear that in some dogs, at least, strong stimulation of the carotid and aortic chemoreceptors can cause a violent generalized excitation in the central nervous system. A weaker excitation of this nature during anoxemia might assist in maintaining the activity of this system in the face of depression by anoxia; termination of anoxemia might then cause immediate unconsciousness and collapse.

The growth of cancer as observed experimentally in the anterior chamber of the frog's eye: BALDUIN LUCKÉ and HANS G. SCHLUMBERGER. The anterior chamber of the eye is an exceptionally favorable site for studying the phenomena of cancer growth. Here, because of the transparency of the overlying cornea, details of growth of transplanted cancer may be observed directly with the microscope as plainly as through a window; such direct observation may be complemented by microphotographs of the living tumor for permanent and objective records. The present experiments deal with the effect on the growth of cancer of two environmental factors known to be of major importance in determining normal growth, namely, surface forces and temperature. The cancer used in these experiments is an adenocarcinoma of the frog, which in structure and behavior resembles the most common kind of cancer in man and animals generally. This tumor readily becomes established in the eye, where it may be studied in successive generations. Such observations have led to the conclusion that the pattern of cancerous growth is influenced decisively by surface forces. Thus, if the outgrowths from the cancer extend into the cavity of the eye where they are completely surrounded by fluid,

and where in consequence interfacial forces are equalized, the resultant form is cylindrical. If, instead, the outgrowths make contact with a firm surface such as the lens, the interfacial relations become such that the edges of the growing tumor are drawn over the lens, forming a spreading membrane. If, however, the proliferating tumor pushes into the clefts of a loose tissue, such as the iris, the invading cells become arranged as spheres or cylinders, again through the operation of surface forces. For studying the effect of temperature on the growth of cancer, the frog carcinoma is particularly good material. Since the temperature of the frog is that of the environment, the effects of temperature may be investigated over a far wider range (4° to 28° C.) than would be possible in warm-blooded animals. The experiments bring out that, as in normal tissue, the most striking effect is acceleration in rate of growth at higher temperatures and retardation at lower. Further, at higher temperatures there is more efficient vascularization, and the character of growth is different, the cancer forming long, branching outgrowths which tend to become distended with fluid. At lower temperature, on the other hand, the outgrowths are short, stubby and more solid. We conclude that the growth of cancer is affected by surface forces and temperature in the same general direction as is the growth of normal tissues. Cancer growth is governed by the same physical factors that govern normal growth.

Large molecules through atomic spectacles: HUGH S. TAYLOR. The highest resolutions now attainable with the electron microscope permit us to examine objects which are about 40 Ångström units in linear dimension. Interatomic distances are, however, of the order of 1 to 3 Ångström units so that to examine the geometry of the constituent units of molecules it is still necessary to construct and study models made to scale in accordance with the best data of physico-chemical science. The Fisher-Hirschfelder atomic models have proved especially useful in this problem of viewing molecules through atomic spectacles. The method of attaching atoms one to another provided by the makers of these models is not very satisfactory. A new method of attachment will be shown which makes complicated molecular models more rugged in the problem of construction and subsequent handling. Colored photographs of models of various molecular structures will be shown to exhibit features of molecular structure which are not immediately evident from the older structural formulae of the chemist. Photographs of molecular models will be used to illustrate structures proposed for various vitamins, hormones and protein materials, in particular those of hair and wool. A new method of folding a polypeptide chain to give the alpha-keratin structure which is superior to those hitherto proposed for these fibrous proteins will be given. Actual models of large molecules will be on exhibition.

Correlated developments in neurology and psychology: KARL SPENCER LASHLEY. Analysis of mental activities reveals that they can be described meaningfully only in terms of their organization. Studies of the integration of nervous activities in the cerebral cortex are finding

types of activity which have many of the characteristics of mental organization. The structure and electric potentials of sensory areas point to a complex interplay of interference patterns or of field forces in which structural elements are subordinate to the influence of masses of excitation. Psychological analysis of the mutual influence of sensory elements in the formation of precepts reveals laws of organization identical with those of physical force-fields. Thus neurology and psychology are approaching a common formulation of the laws of organization of their materials. In studies of motivation and of the variables contributing to intellectual activity there is a similar confluence of the two disciplines toward a common statement of principles of organization.

The genesis of behavior form in fetus and infant: ARNOLD GESELL. The morphogenesis of human behavior becomes apparent at an early fetal stage before the close of the second month of gestation. From the beginning behavior tends to assume characteristic forms and follows an orderly ontogenetic sequence. Premature birth does not alter the normal progressions. The behavior of 37 prematurely born infants with fetal ages varying from 28 weeks to 40 weeks was investigated by systematic developmental examinations, and cinema analysis. The behavior patterns of the premature infant approximate those of a fetus of equivalent age rather than those of a full-term infant of equal age. A film entitled "Infant Eyes and Hands" will be shown to illustrate the growth of behavior patterns and their characteristic forms at fetal and later maturity. Patterns delineated include the tonic neck reflex, primitive grasping, ocular fixation and progressive types of prehension culminating in precise thumb opposition. Behavior has shape in the same sense that limb-bud and finger prints have shape. The genesis of shape is similar for psychic and for somatic patterns. Form phenomena are found at all levels of organization beginning with molecular, colloidal and paracrystalline levels. Behavior forms stand at the summit of a hierarchical continuum. They are not unique manifestations of organization. They are end products of the same morphogenetic factors and forces which are being fruitfully investigated in the fields of biochemistry and experimental

embryology. Experiential and environmental influences inflect and specify, but the primary, provisional and prospective components of pattern are intrinsic. Maturation is the net sum of the gene effects, and as such is the basic determinant of behavior form.

The nature of associations: WOLFGANG KÖHLER. In the classical theory of associations by contiguity the connection between two associated items seems to have been regarded as a neutral bond which remains the same whatever the items in question. More recently this theory has been modified both by Professor Thorndike and by Gestalt psychologists. Thorndike holds that a relation of "belonging" is necessary if two items are to become associated in consequence of their, single or repeated, contiguous occurrence. Gestalt psychologists maintain that the association of such items presupposes their organization within one experiential unit, and that the neural after-effect of such a unit *qua* unit is the fact of association. This Gestalt assumption leads to concrete inferences, because we know from perceptual experience what factors favor the formation of experiential units. Two such factors are similarity and proximity of the items in question, which means that similar items tend to form unitary groups, and that this specific interaction is more likely to occur if the items are neighbors in space and time (contiguity = proximity). The Gestalt interpretation of associations leads therefore to the consequence that, other conditions being equal, similar items will be more strongly associated than items which show no particular resemblance. In several experiments this expectation was fully verified. In fact, the influence of similarity on association is so strong that even very small statistical samples demonstrate it with great consistency. Organization, however, depends upon other factors besides similarity and proximity. At the present time experiments are being undertaken in which the influence of such other factors is tested. In this fashion it may be possible to decide whether an association actually constitutes a neutral connection or whether association is a product of specific interaction between the items in question.

(To be concluded)

OBITUARY

CARY LEROY HILL

CARY LEROY HILL, senior forester of the California Forest and Range Experiment Station, U. S. Forest Service, died on February 26, 1941, at the age of sixty-six. He was one of the true pioneers in American forestry, since he first entered government employment for summer forest work in 1904, and had served his profession continuously for 36 years until his retirement a few months before his death.

Mr. Hill was born at Howell, Michigan, in 1875 and, after graduating from high school, had a varied experience before settling down to his life-calling. He worked for three years for a stove manufacturer, both

in Michigan and New York City, in order to finance his college course. After graduation from the University of Michigan in 1901 with a classical A.B. degree, he taught English and mathematics for a year at the Owosso, Michigan, high school. Going west on a summer excursion he stayed to explore the Cascade Mountains in Washington with the Geological Survey, and spent the following winter on the circulation staff of the *Seattle Post-Intelligencer*, "doing" the lumber camps of the Puget Sound region. It was during this western experience that he became interested in the forests and in 1903 returned to his alma mater to attend the forestry school which was just being estab-

ished that fall. There he was awarded the degree of master of science in forestry in 1905.

Since July 1, 1905, Mr. Hill had been with the Forest Service continuously, with the exception of three years, 1909-12, when as assistant professor of forestry at the University of Michigan, he taught forest utilization, wood technology, mensuration and dendrology. Even during this period, the Service retained him as collaborator. He served for a time as chief of the Forest Products Division of the Regional Office in Denver, as forest examiner on the Sierra National Forest in California, and subsequently in the California Regional Office in San Francisco. At various times he was occupied with land classification, was chief assistant in timber management, had charge of law enforcement in California national forests and later of forest products activities. Since 1927, he had been with the California Forest and Range Experiment Station, where his responsibilities included direction of the products and economics research, and more recently special services in forest land utilization.

Mr. Hill was the author of numerous publications ranging from semi-popular articles in trade journals to technical bulletins and covering such a wide range of topics as wood paving in the United States, law enforcement on the national forests, heptane from California pines, air seasoning of western softwood lumber, marine borers and their relation to marine construction, utilization of El Dorado County land, and many others.

He served as executive officer of the San Francisco Bay Marine Piling Committee, 1919 to 1927, and as chairman of the natural resources committee of the California Economic Research Council throughout the

existence of that organization. He was a senior member of the Society of American Foresters, and served as chairman of the California section of that society from 1927 to 1929. His membership in other learned societies included the American Association for the Advancement of Science, California Academy of Sciences, California Botanical Society and the East Bay Astronomical Association. He was a fellow in the first two of these organizations.

Mr. Hill had a wide circle of friends outside his profession as well as within it, and his personal contacts reached far beyond the United States to Europe, Africa, Australia and the Orient. The forestry profession and American scientists as a group have lost a staunch and able colleague.

EDWARD C. CRAFTS

CALIFORNIA FOREST AND RANGE
EXPERIMENT STATION

RECENT DEATHS

DR. SAMUEL BRADFORD STONE, assistant professor of chemistry at Brooklyn College, died on May 7 in his forty-fifth year.

DR. WILLIS COHOON CAMPBELL, professor of orthopedic surgery at the College of Medicine of the University of Tennessee, died on May 4 at the age of sixty years.

SIR ALBERT SEWARD, from 1906 to 1936 professor of botany at the University of Cambridge, died on April 11 at the age of seventy-seven years.

SIR JAMES GEORGE FRAZER, anthropologist, author of "The Golden Bough," died on May 7 at the age of eighty-seven years. Lady Frazer died a few hours later.

SCIENTIFIC EVENTS

THE NEW YORK ZOOLOGICAL PARK

THE official opening of the African Plains in the Bronx Zoological Park took place on May 1. This is a first step toward exhibiting animals according to their distribution by continents.

The opening ceremony was marked by short addresses by Mayor La Guardia, Sir Gerald Campbell, minister from Great Britain, Commissioner Robert Moses and the Honorable J. J. Lyons, president of the Borough of the Bronx. President Fairfield Osborn, of the New York Zoological Society, made a brief opening address which follows:

This ceremony welcomes the life of a far-away continent to New York. It marks the opening of a new vista to the wonders of nature. It spells the beauty of living things, creatures age-old, yet ever new. We are here to greet this sight, and millions of others will do likewise before the year is out, grateful for an hour of recreation,

snatched from these troubled days. We can be refreshed for a while from the spectacle of man's cruel and needless destruction of himself. We should have no patience with those unthinking persons who rant that man, in his present cruelties, is reverting to primitive nature—to the so-called law of the jungle. No greater falsehood could be spoken. Nature knows no such horrors. Through the ages, from Aristotle to Darwin, the great philosophers have interpreted the equitable principles governing all living things. Hitler, and his totalitarian system, whatever battles he may win, is bound to lose in the end. Man's age-long insistence on freedom for the individual isn't anything in the world but the straight, pure, unadulterated urge of any higher mammal. Add to that man's spirit and soul. The totalitarian system may be found among ants and bees—it is impossible for man! I wish that dictators had studied some of these things before they started this catastrophe. Let me remind you again that the world of animal life is more than a sideshow—it is related historically, psychologically, physically,

to man and his background, or perhaps I should say, man is part of it. The zoo therefore becomes a vivid expression of nature. We have a vision for the zoo of the future. It will be not only a place in which to be refreshed, to find recreation, but also a place in which to learn of the principles which govern all life. I am not glorifying animals—I am merely saying we would do well to know more of their scheme of things; we in turn, will get a better understanding of our own scheme of things.

This is a new day in zoological park planning. The distribution, on the various continents of this earth, of different types of animals—their evolution, their interdependence and social relationships—provide a miracle-story. It is up to us to tell it. In carrying out these new developments we shall be bringing the animals, to the greatest degree possible, out from behind their bars and return them to their natural surroundings.

A private citizen has made possible, for the public benefit, this first major step toward the zoo of the future. He does not want any gratitude but he can not escape it. It will come to him, whether or not he desires it, from the millions of persons who from this day on will enter here to enjoy and to learn.

THE CHICAGO MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

THE forty-fourth annual meeting of the American Society for Testing Materials will be held at the Palmer House, Chicago, from June 23 to June 27.

Separate sessions will be devoted to such topics as iron, ferro-alloys; water, which includes a Symposium on Problems and Practice in Determining Steam Purity by Conductivity Methods; non-ferrous metals (two sessions); cementitious and building materials; steel, effect of temperature; fatigue of metals, corrosion; plastics, and concrete and concrete aggregates. There will be a joint session with the Western Society of Engineers dealing with three topics of specific local interest, namely, water supply, sewage disposal and sanitary conditions. This may involve some discussion of materials and problems in connection with the Chicago subway. In addition there will be a large number of papers and reports including a paper on tests of glued laminated wood beams impregnated with creosote, and the effect of rate of loading on tensile strength of cord and yarn. Other papers will cover a laboratory test for the ignitibility of coal, a study of the grindability of coal and the fineness of pulverized coal, and studies on the measurement of water vapor in gases. There will be a discussion of the performance specifications for greases and two papers cover the influence of recovery temperature on the ductility of recovered asphalt and the fundamental significance of the Oliensis spot test.

Throughout the week of the meeting some two hundred technical committees of the society are expected

to meet. On Monday the whole day will be devoted to these meetings. The address of the president, Dr. William M. Barr, chief chemical and metallurgical engineer of the Union Pacific Railroad Company, will be given on Tuesday morning at the first formal session. He will speak on "Speed, Specifications, and Safety"; J. H. Van Deventer, editor of *The Iron Age*, will make an address entitled "Mobilizing Materials for Defense."

The sixth exhibit of Testing Apparatus and Related Equipment in which a number of leading companies in the instrument and related fields will take part, will be in progress throughout the five days of the meeting. In addition several committees will sponsor exhibits, including exhibits of paint, varnish, lacquer and related products; lime; radiographic testing and welding research. A number of industrial, university and government research laboratories will also participate. They will show equipment and apparatus that has been developed for special work. This exhibition is held every two years. This year it will include the fourth photographic exhibit on "Materials, Testing and Research."

Local arrangements for the meeting are in charge of a Chicago committee, headed by E. R. Young, metallurgical engineer, of the Climax Molybdenum Company. Serving with him are some fifty leading technical executives in the district.

THE ONE HUNDRED AND TWENTIETH ANNIVERSARY OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE

THE Philadelphia College of Pharmacy and Science will celebrate the completion of its one hundred and twentieth anniversary on June 3. An extensive program has been arranged at the College Hall, the scene of activities commemorating the establishing of the college, which was the first of its kind in the Americas. The celebration, to be held in conjunction with the annual Alumni Homecoming Day, will be marked by the first official address of the recently elected president of the college, Dr. Ivor Griffith. It will be entitled "What the Future Has in Store for the Philadelphia College of Pharmacy and Science."

The formal program begins at noon with a luncheon, to be given in honor of the Class of 1891, alumni who have successfully completed fifty years of professional and scientific service. These men become members of a group of honored graduates, the "Semi-Centennialists." They will receive certificates making special recognition of their service.

Following this will be the annual meeting of the Alumni Association at which the address of the retiring president, Charles T. Pickett, for thirteen years

secretary of the Philadelphia Association of Retail Druggists, will be given. He will describe the progress of the college during the last twenty years.

There will be a "Jubilee Dinner" in the evening at which the toastmaster will be Colonel Samuel Price Wetherill, chairman of the Board of Trustees. A group of addresses will follow, also bearing upon the record of the past twenty years. Two decades ago, at its centennial, an extensive program of educational advancement was prepared. That program has advanced even more favorably than was expected. Now, completely equipped new buildings stand in pleasant surroundings as the visible tribute to its success. In addition, the courses of study have been materially expanded and lengthened. Graduate studies and programs of research have been instituted and there are now fifty members of the faculty.

Much of this record will be outlined by the president-emeritus, Dr. Wilmer Krusen, who for fourteen years served as head of the college and who is well known for his former service as head of the Department of Public Health of the City of Philadelphia. Dr. Ambrose Hunsberger, professional pharmacist of the city, will speak for the Board of Trustees, followed by the dean of science, Dr. J. W. Sturmer, formerly president of the American Association of Colleges of Pharmacy. The cooperation of alumni and friends during the past decades will be recognized by Mr. Pickett, for the alumni, and by Dr. Wilmer Krusen.

Dr. E. Fullerton Cook, head of the Operative Pharmacy Department of the college and active on the Board of Trustees, who is chairman of the Committee of Revision of the Pharmacopoeia of the United States, will describe the improved financial condition of the college. Gifts of more than \$1,000,000 have been received through the past two decades.

THE NINTH SUMMER CONFERENCE ON SPECTROSCOPY AND ITS APPLICATIONS

A NINTH Summer Conference on Spectroscopy and Its Applications will be held at the Massachusetts Institute of Technology on July 21, 22 and 23. Morning and afternoon sessions will be held during three days, with discussions by qualified experts on spectroscopic analysis of materials and on other applications of spectroscopy to biology, medicine, chemistry, metallurgy, mineralogy and to industrial and engineering problems.

This conference will repeat to a considerable extent the type of program presented at the conferences held during the past eight summers. The early sessions will be devoted principally to applications of spectroscopy to the analysis of materials. Other topics to

be considered are absorption spectrophotometry, photographic photometry, biological and chemical effects of spectral radiation, industrial applications of spectroscopy, analysis of spectra and the measurement of wavelengths. The more technical and theoretical papers will be reserved for the later sessions.

As soon as it has been prepared, copies of the detailed program of the conference will be sent to any one interested. Attendance at the conference will be limited to two hundred, and experience in previous years indicates that those who plan to attend from a distance should signify their intention in advance, to insure availability of space. No fees are charged for attendance.

Requests for copies of the program, for reservations, or for further information, should be addressed to Professor G. R. Harrison, Massachusetts Institute of Technology, Cambridge, Mass.

CONFERENCE ON MOLECULAR STRUCTURE

THE Graduate School of the Ohio State University will hold a conference on Molecular Structure in the first week of the summer quarter, from June 25 to June 28.

A member of the staff will review a topic and, after time for discussion, invited speakers will read papers on recent research along that line. An abbreviated program follows:

Wednesday, June 25. "The Electronic Structure of Molecules": A.M.—Professor L. H. Thomas, the Ohio State University (review); P.M.—Professor G. Herzberg, the University of Saskatchewan, and Professor Robert Mulliken, the University of Chicago; Evening—A discussion on nomenclature.

Thursday, June 26. "Rotation-Vibration Spectra": A.M.—Professor H. H. Nielsen, the Ohio State University (review); P.M.—Professor D. Dennison, the University of Michigan, and Professor G. Herzberg, the University of Saskatchewan.

Friday, June 27. "Thermodynamic Properties of Molecules": A.M.—Professor H. L. Johnston, the Ohio State University (review); P.M.—Professor E. Bright Wilson, Harvard University, and Professor L. H. Thomas, the Ohio State University.

Saturday, June 28. "Large Molecules": A.M.—Dr. E. Mack, Battelle Memorial Institute (review), and Professor Henry Eyring, Princeton University.

The conference will be open without fee to any who wish to attend it and any one who desires to do so is invited to take part in the discussions. Accommodation is available for men in Baker Hall, University Dormitory, at \$1.00 per night. Further information may be obtained from Professor L. H. Thomas, the Ohio State University, Columbus, Ohio.

THE WASHINGTON MEETING OF THE AMERICAN GEOPHYSICAL UNION

At the twenty-second annual meeting of the American Geophysical Union held in Washington, D. C., on April 30, May 1, 2 and 3, officers were elected for a term of three years beginning on July 1, as follows:

OFFICERS OF THE UNION: Dr. W. C. Lowdermilk, president; L. H. Adams, vice-president; J. A. Fleming, general secretary continuing in office until June 30, 1943.

OFFICERS OF THE SECTIONS: *Geodesy*, R. M. Wilson, president; C. R. Longwell, vice-president; W. D. Sutcliffe, secretary, continuing in office until June 30, 1943. *Seismology*, H. E. McComb, president; V. C. Stechschulte, vice-president; F. Neumann, secretary, continuing in office until June 30, 1943. *Meteorology*, C. W. Thornthwaite, president; C.-G. Rossby, vice-president; H. D. Harradon, secretary. *Terrestrial Magnetism and Electricity*, E. A. Eck-

hardt, president; H. F. Johnston, vice-president; J. W. Joyce, secretary. *Oceanography*, P. C. Whitney, president; H. U. Sverdrup, vice-president; Waldo E. Smith, secretary. *Volcanology*, A. F. Buddington, president; J. F. Schairer, vice-president; J. S. Vhay, secretary. In the sections of Hydrology and Tectonophysics there were no elections, the present officers remaining in office until June 30, 1943, as follows: *Hydrology*, N. C. Grover, president; M. P. O'Brien, vice-president; K. H. Beij, secretary. *Tectonophysics*, L. H. Adams, president; R. A. Daly, vice-president; D. T. Griggs, secretary.

On the evening of April 30, the third award of the William Bowie Medal of the American Geophysical Union "for distinguished attainment and outstanding contribution to the advancement of cooperative research in fundamental geophysics," was made to Dr. J. A. Fleming. This presentation was followed by an address by President R. M. Field on "Geophysics and World Affairs."

SCIENTIFIC NOTES AND NEWS

THE Walker Prize for Cancer Research of the Royal College of Surgeons of England has been awarded to Dr. Peyton Rous, of the Rockefeller Institute for Medical Research.

THE Patron's Medal of the Royal Geographical Society, London, has been awarded to Dr. Isaiah Bowman, president of the Johns Hopkins University, for his travels in South America and for his great services to the science of geography while director of the American Geographical Society of New York.

DR. HENRY SIGERIST, director of the Institute of the History of Medicine of the Johns Hopkins University, and Dr. Esmond R. Long, professor of pathology at the University of Pennsylvania, director of the Henry Phipps Institute and president of the American Association of the History of Medicine, have been elected honorary members of the Atheneum of the History of Medicine, Buenos Aires.

IN a celebration on May 11 of the discovery of uranium, students of chemistry at the College of the City of New York presented a scroll to Dr. Enrico Fermi, of Columbia University, in recognition of his work in radioactive chemistry. Dr. Fermi, in accepting the award, outlined the history of experiments with uranium.

THE annual award of merit, given by the Alumni Association of Stevens Institute of Technology for distinguished service to the school, was presented on May 10 to Dr. Franklin De Ronde Furman, professor of mechanism and machine design, who will retire on

September 1, after having served for forty-eight years on the faculty, the last thirteen as dean. Dr. Furman received the award from Dr. Harvey N. Davis, president of the institute, at the alumni dinner at the Union Club. The retiring dean will be succeeded next September by Frederic E. Camp, formerly assistant to the dean of Princeton University and a member of the Stevens Board of Trustees.

DR. F. S. MCKAY has been elected a veteran member of the International Association for Dental Research. This action, which grants a life membership, was in recognition of his outstanding contributions to endemic mottled enamel.

CHARLES RAY, JR., research fellow of the Blandy Experimental Farm of the University of Virginia, was awarded the annual research prize of the Virginia Academy of Science at its annual meeting in Richmond on May 2 and 3, for his paper entitled "Cytology and Genetics in the Flax Genus, *Linum*."

DR. JOHN H. YOE, professor of chemistry at the University of Virginia, and Dr. Lyle G. Overholser, research assistant in analytical chemistry, have been given the 1941 Interacademy Award for their paper on the "Application of a New Class of Organic Reagents to the Detection and Determination of Palladium." This paper won the Jefferson Award of the Virginia Academy of Science at its annual meeting last May and thus automatically entered competition for the Interacademy Award, which is the Jefferson Gold Medal and a cash prize of \$100 for the

paper adjudged the best from the Academies of Science of Florida, Georgia, North Carolina, South Carolina and Virginia.

DR. W. H. GATES, head of the department of zoology of the Louisiana State University, on April 26 was elected president of the Louisiana Academy of Sciences at the eleventh annual convention held at Lake Charles. The meeting in 1942 will be held at New Orleans.

DR. JAMES HOWARD MEANS, Jackson professor of clinical medicine at the Harvard Medical School, was elected president of the Association of American Physicians at its fifty-sixth annual meeting at Atlantic City. Dr. George Blumer, David P. Smith clinical professor of medicine at the School of Medicine of Yale University, was elected vice-president. Dr. Alphonse R. Dochez, John E. Borne professor of medical and surgical research at the College of Physicians and Surgeons of Columbia University, was elected to the council.

DR. HENRY C. SWEANY, of Chicago, was named president-elect of the National Tuberculosis Association at the recent meeting in San Antonio, Texas.

DR. RALPH H. MUELLER, professor of chemistry at New York University, was elected chairman of the New York Section of the American Chemical Society at the annual meeting of the section on May 9. Dr. Charles N. Frey, director of the Fleischmann Laboratories of Standard Brands, Inc., was chosen chairman-elect, to take office next year.

The Experiment Station Record reports that Dr. William F. Kirkpatrick, head of the department of poultry husbandry of the University of Connecticut, retired on February 1. His service to the institution began in 1912 and was preceded by five years in the Rhode Island Station and two years in the Mississippi College and Station. He has been succeeded by Dr. H. M. Scott, associate professor of poultry husbandry and poultry production in the Kansas College and Station.

PROFESSOR FRANK B. ROWLEY, director of the Engineering Experiment Laboratories of the Institute of Technology of the University of Minnesota, has become head of the department of mechanical engineering. He retains his post as director of the Engineering Experiment Station and of the Oak Street Laboratories.

THE National Organization of Women in Scientific Research of Sigma Delta Epsilon has awarded the \$1,500 National Research Fellowship for 1941-1942 to Dr. Frances Dorris Humm, research assistant in embryology at the Osborn Zoological Laboratory of Yale University. She is making a study of "the

origin and physiology of the pigment cell in the chick and the rat."

DR. DONALD D. VAN SLYKE, member of the Rockefeller Institute for Medical Research, has been elected president of the American Bureau for Medical Aid to China, an affiliate of United China Relief. He succeeds Colonel Theodore Roosevelt, Jr., who resigned when he became commander of the 26th Infantry Regiment.

ACCORDING to *Nature*, Dr. W. W. C. Topley, professor of bacteriology and immunology at the University of London, has been appointed secretary of the British Agricultural Research Council in succession to Sir Edwin Butler, who has retired on account of ill health.

DR. RALPH W. CHANEY, professor of paleontology at the University of California at Berkeley, and Dr. Erling Dorf, paleobotanist of Princeton University, expect to leave about the middle of June for Disco Island, off the west coast of Greenland, under the auspices of the American Greenland Commission, which has been supplying the inhabitants of the Danish colony from New York since the German occupation of Denmark. Dr. Chaney plans to obtain fossil specimens of angiosperms.

The News Bulletin of the Institute of International Education reports that Dr. Zing Yang Kuo, the Chinese psychologist, head of the China Institute of Physiology and Psychology at Chungking, formerly president of Chekiang University in Hangchow, arrived in California recently from Chungking, where he has spent a year. Professor Kuo has long been closely associated with Chiang Kai-shek and is concerned with furthering the cultural relations of China with the United States and with Great Britain.

DR. EARL E. KLEINSCHMIDT, associate professor of public health and preventive medicine at Loyola University, who is chairman of the department of preventive medicine, public health and bacteriology, has leave of absence for three months to enable him to work at Washington in the national defense program making health studies, plans for the protection, care and guidance of students employed in vocational training for defense work in industry and supervising courses of instruction for intensive training of supervisors of health education in schools.

DR. COLIN G. FINK spoke on May 1 as the third annual guest lecturer of the Powder Metallurgy Laboratory of the Stevens Institute of Technology on the "Powder Metallurgy of Ductile Tungsten."

DR. J. O. PERRINE, assistant vice-president of the American Telephone and Telegraph Company, gave a demonstration lecture at the Pennsylvania State College on April 28 on "The Artificial Creation of

Speech." The principal exhibit was the voder. The lecture was sponsored by the Pennsylvania State Student Branch of the American Institute of Electrical Engineers, Sigma Xi and Sigma Pi Sigma.

DR. H. KEFFER HARTLINE, associate professor of physiology at the Cornell University Medical College, spoke on "The Electrical Activity of the Eye" at the annual initiation dinner of the Kappa Chapter of Sigma Xi. The dinner was held at the Men's Faculty Club of Columbia University on May 6.

DR. HARLAN TRUE STETSON, of the Massachusetts Institute of Technology, addressed the University of Michigan Chapter of Sigma Xi at the annual banquet held in Ann Arbor on April 30. He spoke on "The Sun and the Atmosphere."

DR. WILMER SOUDER, principal physicist of the National Bureau of Standards, delivered the annual lecture before the University of Kentucky Chapter of Stefan Bergmann. In addition single lectures have "Scientific Evidence and the Conviction of the Criminal."

As a contribution toward assisting essential American industries in the defense program, Brown University announces a twelve-week summer session of intensive instruction and research in the field of advanced mechanics. Besides a seminar in dynamics and elasticity, regular courses are offered in partial differential equations, fluid dynamics and elasticity. The regular staff for the summer session consists of Dr. Richard von Mises, Dr. Kurt O. Friedrichs, Dr. I. S. Sokolnikoff, Dr. Jacob D. Tamarkin and Dr. Stefan Bergmann. In addition single lectures have been arranged by ten of the leading experts on the practical and theoretical sides of mechanics. Information may be obtained from the dean of the Graduate School.

THE eighteenth annual meeting of the Virginia Chapter of Sigma Xi was held on April 18 at the University of Virginia. Twenty-four members and nineteen associates were initiated into the society. The speaker this year was Dr. George R. Clark, of the department of anatomy of the University of Pennsylvania. His subject was the "Growth and Behavior of Blood Vessels and Certain Other Tissues as Observed Microscopically in the Living Adult Mammal," illustrated by lantern slides and moving films.

THE third annual field meet of the Texas Herpetological Society, under the presidency of Dr. C. S. Smith, of the Southwest Texas State Teachers College, was held on April 19 and 20 at Sealy, with an attendance of thirty-five. Activities included field collections, a barbecue and a campfire discussion of herpetological problems. The guests of the society in-

cluded Karl P. Schmidt, of the Field Museum of Natural History, Chicago, who in an informal talk at the campfire told of his experiences in collecting crocodiles and incidents of his trip to Peru. Officers elected for the coming year were: Dr. Leo T. Murray, of Baylor University, *president*; Jack Davenport, of the Witte Memorial Museum, San Antonio, *vice-president*; Ottys Sanders, manager of the Southwestern Biological Supply Company, Dallas, *secretary-treasurer*.

THE eleventh annual summer Research Conference of the Johns Hopkins University will be held from June 2 to 6 and 9 to 13 at the Henlopen Hotel, Rehoboth Beach, Del. The first week, with Dr. Leslie Hellerman as chairman, will be devoted to a series of biochemical papers on certain aspects of isotopic work, intermediary metabolism, immunochemistry, protein surface films and natural fibrous proteins. Drs. Rudolf Schoenheimer, William C. Stadie, Vincent J. Schaefer, Michael Heidelberger, M. E. Krahf, W. W. Davis, Joseph Shack and Milton Harris will be the speakers. The second week, with Dr. Alsoph H. Corwin as chairman, will include discussions of chromatographic analysis, isomerization, alkylation, polymerization and the kinetics, mechanisms and thermodynamics of organic reaction. The speakers will be Drs. Frederick D. Rossini, Dorothy Wrinch, Walter A. Patrick, Stephen Brunauer, Alfred W. Francis, H. Mark, Henry Eyring, F. O. Rice and Dr. Corwin. The conference affords an opportunity for a group of specialists to discuss informally various fundamental topics in biochemistry and in organic chemistry. The attendance is kept sufficiently small to allow all present to participate in the discussions. The schedule is so arranged as to leave time for recreation, including surf bathing, golf, fishing, boating and tennis. Further information may be obtained from the director of the conferences, Dr. P. H. Emmett, the Johns Hopkins University, Baltimore, Md.

THE South Carolina Academy of Science held its eighteenth annual meeting at the University of South Carolina on April 26 with an attendance of about three hundred. The morning session was devoted to topics of general interest and to the address of the retiring president, E. B. Chamberlain. The afternoon session was divided into sections for the physical sciences, the biological sciences and for philosophy and psychology. G. Robert Lunz, Jr., of the Charleston Museum, received the Jefferson Award for a paper entitled "Polydora, a Pest in South Carolina Oysters." The Research Grant for 1941 of the American Association for the Advancement of Science was divided between Mr. Lunz and Bud E. Smith, of Coker College. The following officers were elected: *President*,

Dr. F. W. Kinard, Medical College of the State of South Carolina; *Vice-president*, Dr. Velma D. Matthews, Coker College; *Secretary-treasurer*, Dr. Charles F. Poole, U. S. Regional Vegetable Breeding Laboratory; *Executive Committee*, E. B. Chamberlain, Dr. G. G. Naudain, H. E. Sturgeon, C. D. Riddle and Dr. H. L. Hunter; *Curator*, Dr. James E. Copenhaver; *Representative to the American Association for the Advancement of Science*, Dr. Gilbeart H. Collings. The meeting will be held in Charleston in 1942.

CEREMONIES at the laying of the cornerstone of the Langley Porter Clinics, San Francisco, were held on April 5. The exercises included addresses by the Honorable Culbert L. Olson, governor of California, Dr. Robert G. Sproul, president of the University of California, and Dr. Langley Porter, dean emeritus of the School of Medicine. Dr. Aaron J. Rosanoff, director of the Department of Institutions of the State of California, was master of ceremonies. The Langley Porter Clinics, a part of the Department of Institutions, is being constructed at the Medical Center of the university. It will have approximately one hundred beds and an out-patient department for use in the care, study and treatment of acute psychiatric cases.

AN ornithological expedition to southern Texas, Arizona, New Mexico and Colorado, to collect material for proposed new exhibits, was sent out by the Field Museum of Natural History early in April. Emmet R. Blake, assistant curator of birds, and Melvin S. Traylor, Jr., associate in ornithology, are conducting the expedition. They are traveling by automobile and will camp in collecting regions. Collections of reptiles and small mammals are also being made. The expedition, after working in localities ranging from the plains of the deep Southwest to the high Rocky Mountains, is expected to return to Chicago late in July.

At the meeting of the Board of Directors of the Finney-Howell Research Foundation, Inc., the following annual fellowships were awarded: Dr. Glenn

Horner, Algire, to work at the National Cancer Institute, Bethesda, Md.; Dr. Earl Leroy Green, to work at the Jackson Memorial Laboratory, Bar Harbor, Me.; Dr. Joseph Gilbert Hamilton, to work at the Radiation Laboratory, University of California, Berkeley, and Dr. Rose I. Shukoff, to work at the Glasgow Royal Cancer Hospital, Glasgow, Scotland. Fellowships were renewed for a year for Drs. Margaret Nast Lewis, Bernard E. Kline, Julius Charles Abels, Alfred Marshak, John F. Menke and Paul C. Zamecnik. Fellowships carrying an annual stipend of \$2,000 are awarded for the period of one year, with the possibility of renewal up to three years, at the annual meeting of the Board of Directors, held at the end of February. Applications must be made on the blank forms furnished by the secretary, and must be filed in the office of the foundation before January 1 of each year. Fellowships are awarded only for research into the cause or causes and the treatment of cancer.

THE regular annual meeting of the Trustees of the Elizabeth Thompson Science Fund was held on April 21. Grants were awarded as follows: \$500 to Dr. Rose L. Mooney, H. Sophie Newcomb Memorial College, for a study of the structure of the monosaccharides; \$250 to Dr. Edward Girden, Brooklyn College, for a study of pupillary changes in human subjects who have been subject to the process of conditioned reflexes; \$150 to Dr. Philip Wright, Montana State University, for a study of the relation of color change to the reproductive cycle in the weasel; \$154 to Dr. Clinton M. Osborn, the Ohio State University, for physiological and chemical studies on the formation of melanin; \$145 to Dr. Robert H. Williams, Boston City Hospital, for a study of some of the pharmacologic effects of the thyrotropic hormone. The following trustees and officers of the fund were reelected: *President*, Gregory Baxter; *Treasurer*, C. P. Curtis, Jr.; *Secretary*, Jeffries Wyman, Jr.; *Trustees*, G. B. Wislocki, A. C. Redfield, J. C. Slater.

DISCUSSION

HEAVY CARBON PRODUCTION BY THERMAL DIFFUSION

CONSIDERABLE experience has now been gained in the concentration of C^{13} using methane gas in a multi-stage thermal diffusion apparatus of the type already described.^{1,2} In view of the interest in this heavy carbon for tracer-atom work, a brief statement of these results would seem to be of value.

¹ W. W. Watson, *Phys. Rev.*, 56: 703 (L), 1939; 57: 899, 1940.

² H. L. Schultz and W. W. Watson, *Phys. Rev.*, 58: 1047, 1940.

To obtain a larger separation factor, at the "heavy" end of the six-unit all-copper apparatus² a 3-meter glass column has been attached by means of a pair of glass convective coupling tubes. The hot surface of this last unit is 6 mm in diameter, heated by a single tungsten wire along its axis. The annular space between hot and cold surfaces is 4.7 mm in width, and at the lower end a collecting volume of from $\frac{1}{2}$ to 2-liter capacity is convectively attached. All hot surfaces have been held at 350° C., the power consumption being about 6½ kw with a gallon of water per minute to cool the outer surfaces. The total length

of working column is 15 meters, with the "staggering" of the annular spaces of successive columns approximately producing the desirable balancing of transport of the rare isotope throughout the apparatus. The volume of all the columns plus coupling pipes is about 9 liters. At the "light" end the gas is maintained at the normal isotope ratio. Samples of the gas enriched in C^{13} are burned to CO_2 and analyzed in a mass spectrometer similar to the one described by Nier.³

Using a collecting volume of 500 cm^3 it was found that the gas increased in C^{13} content at a fairly uniform rate for 68 days, the separation factor (ratio of the isotope ratios at the two ends of the apparatus) then being 31.8. Operation for the next 21 days produced no further increase in C^{13} concentration. The continuance of these observations was for the purpose of seeing whether the leveling-off did not originate in incorrect "staggering" of column sizes, for in that case another concentration wave of gas would eventually arrive at the "heavy" end.⁴ At the end of this time this end-volume was isolated from the last diffusion column, cut off and replaced by a 2-liter volume. After evacuation connection of this volume with the last column was reestablished, the enriched gas in the last columns going into this end-volume while fresh methane at the same time entered at the "light" end.

Although according to the theory⁵ the rate of increase of concentration of the heavy isotope should be nearly proportional to the mass of gas in the end-volume, the time rate of increase of separation factor was now found to be reduced only from 0.447 units per day to 0.304 units per day when this volume was quadrupled. Apparently for most efficient operation the collecting end-volume must not be smaller than the volume of the last column or two, for in reality the last portion of the thermal diffusion apparatus is part of the end-volume. The last 3-liter glass column has a volume of about one liter.

This better production rate amounts to 67 cm^3 per day of methane, 20 per cent. of whose carbon is the heavy variety, or 268 cm^3 per day of 5 per cent. C^{13} , which would perhaps be enough initial concentration for many tracer-atom experiments. This is a transport of a little over 7 mg of C^{13} per day, just 1/20 of the production rate reported by Hutchison, Stewart and Urey⁶ for the chemical exchange method using HCN gas. This thermal diffusion apparatus consumes 156 kw hours per day, and at this rate the production

of a gram of C^{13} in CH_4 at 20 per cent. C^{13} concentration would take about 22,000 kw hours. The consumption of dollars depends upon your power cost. I compute that the cost to us would be about \$300, exclusive of labor charges.

The thermal diffusion method for the concentration of C^{13} obviously can not compete with the chemical exchange method. It does have certain advantages, however, such as elimination of a very poisonous substance, compactness of apparatus, minimum time required for servicing once it is set into operation, and freedom from breakdowns (this apparatus has now been running continuously for 5½ months). My biochemical friends tell me that their tracer-atom experiments are done with a few mgs of material, not grams. It is thus clear that a thermal diffusion apparatus such as this could be operated in the corner of any biochemical laboratory, serviced by an assistant in a small fraction of his working time, and would produce at reasonable cost sufficient heavy carbon for a considerable amount of tracer-atom experimentation.

WILLIAM W. WATSON

SLOANE PHYSICS LABORATORY,
YALE UNIVERSITY

A GIANT RODENT FROM THE OLIGOCENE

AN unusual discovery of the 1940 field season was an Oligocene rodent remarkable not only as the largest known rodent of such antiquity but also as a survivor of a group, the Paramyinae, hitherto believed to have become extinct at about the end of the Eocene. The unique specimen was found by Mr. Kenneth Briggs, of Baker, Montana, who kindly presented it to the American Museum of Natural History, and consists of fairly complete skull and jaws, most of a fore limb and other fragments. The animal is also remarkable as a wholly new and individually large element in the White River fauna, which has been longer and more intensively worked than any other in the American Tertiary. A revision of this great fauna is now being completed by Professor W. B. Scott and colleagues, and the present preliminary note is published at his request in order that this striking form may be cited by name in the addenda to that revision. A full, illustrated description of the new rodent will be published later this year in *American Museum Novitates*.

Manitsha tanka, new genus and species

Type.—Amer. Mus. No. 39081.

Horizon and Locality.—Middle Oligocene, White River Group, Slim Buttes, Harding County, South Dakota.

Definition.—A paramyine rodent resembling *Ischyrotomus*; incisors relatively larger and less compressed; infraorbital foramen lower and smaller; rostrum deeper; anterior zygomatic root high, nearly vertical; digits of manus relatively stout, unguals elongate and compressed as in *Ischyrotomus* but notably deeper and

³ A. O. Nier, *Rev. Sci. Inst.*, 11: 212, 1940.

⁴ S. B. Welles, *Bull. Am. Physical Soc.*, 16: 12, 1941, has discovered that a step-wise increase of concentration with time occurs if the transport of the rare isotope in the different portions of the apparatus is not balanced by proper "staggering" of successive columns.

⁵ W. H. Furry, R. C. Jones and L. Onsager, *Phys. Rev.*, 55: 1083, 1939.

⁶ C. A. Hutchison, D. W. Stewart and H. C. Urey, *Jour. Chem. Physics*, 8: 532, 1940.

more curved. Condylbasal length of skull about 160 mm.

Affinities.—Last and largest known representative of a line of robust paramyines represented by *Pseudotomus* in the middle Eocene and *Ischyrotomus* in the later Eocene. Relationship to *Paramys*, *sensu stricto*, less close and probably through an early Eocene common ancestry as yet undefined. Related in a broader way to the ischyromyids in general, but not close to any other known Oligocene genus.

GEORGE GAYLORD SIMPSON

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NATURAL HISTORY

THE VELOCITY OF LIGHT

THE note concerning "The Speed of Light," printed in *Science News* in the issue of *SCIENCE* for April 4 on page 10, calls attention to recent work by Dr. Wilmer C. Anderson.

The "group velocity" correction factor of Dr. An-

derson, at its quoted value of 6.92 km, is only about 0.00231 of one per cent. of the speed which he finds (299,776 km/sec). The drop from the Michelson value of 1926 is 20 km, or about 0.00667 of one per cent.

Moreover, the table of values given in *SCIENCE* for 1927, September 30, shows a continuous fall in values from 1849 to date, except for the 1855 value. The total fall in values from the 1849 value to that of Dr. Anderson is 4.32 per cent. Why always downward? Is it possible that all the errors of measurement were on the same side of the true value? This seems improbable.

Though I like to believe that the speed of light is constant, further measurements will be followed with much interest.

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SCIENTIFIC BOOKS

BIOLOGICAL OXIDATIONS

Mechanisms of Biological Oxidations. By DAVID E. GREEN. 181 pages, bound. Cambridge University Press. 1940. \$2.75.

THE announcement of a monograph on "Biological Oxidations" by D. E. Green evoked high hopes and expectations. These were in part founded on the belief that the author, by virtue of his American upbringing and training and his subsequent extensive scientific activity in England, was predestined to achieve a well-balanced synthesis of the subject-matter, drawing equally on the contributions made on both sides of the Atlantic. His competence to do this job well was assured not only by his own creditable experimental contributions but even more so by his previously demonstrated gift to present difficult problems in a lucid manner. Furthermore, a book suited for the beginner and dealing with the present status of the field in a moderate space was in definite demand, since it was to fill the gap between such excellent but necessarily limited review articles as that by E. S. G. Barron (*Physiological Review*, 19: 184, 1939) and the more comprehensive and greatly detailed treatments, as that in Oppenheimer's Supplement to his hand-book on "Enzymes."

A careful study of the book leads to the conclusion that it is definitely useful; useful in the sense that it may be recommended to students and teachers alike as a guide into the labyrinth of tricks by which nature contrives to make the rather inert and sluggish oxygen gas "combust," at body temperature and in a neutral medium, substances like succinic acid which the chemist

must overwhelm by boiling them with chromic acid. It is an achievement to cram 178 pages full with experimental facts and detailed information and to end up with a thoroughly readable treatise which avoids successfully overtaxing the average reader's capacity for assimilating the material and which keeps his interest alive to the last page. The comments which follow are offered in a spirit of constructive criticism and are not meant to detract from the intrinsic value of the book.

To begin with the title of the book, it might perhaps read more appropriately, "On the preparation and properties of oxidative enzymes; with an appendix on organized systems." Of a total of 178 pages text, 163 are taken up by introductory remarks on general properties of oxidative enzymes and by subsequent, well-organized chapters on iron porphyrin protein, pyridinoprotein, flavoprotein, copper (and zinc) protein and thiaminoprotein enzymes, cytochrome-reducing dehydrogenases and unclassified oxidative enzymes. It is doubtful whether the inclusion of preparative details in a monograph of this size is beneficial, since a worker interested in the isolation of a given enzyme will probably want to consult the original publication anyway. Space thus saved might have been devoted profitably to an expansion of the last chapter dealing with reactions in organized and integrated systems. This does not necessarily mean that cellular respiration and intermediary metabolism are regarded as integral parts of the topic of biological oxidation. These subjects are, perhaps, more within the realm of physiology and physiological chemistry in general. But phenomena like those observed in reconstructed systems

where several enzymes, coenzymes and substrates co-operate, *e.g.*, carrier-linked reactions which the author has so successfully explored, the study of the function of enzymatic and non-enzymatic catalysts within the living cell, catalytic cycles involving metabolites and other intermediates, would have deserved a fuller discussion. Certain fundamentally important topics such as the relationship between oxidation-reduction potentials and the line-up of oxidative catalysts in cellular respiration or the rôle of semiquinoid and other radicals in oxidative catalyses are barely touched upon.

The center of gravity of the book is situated in Cambridge, England, on the south side of Downing Street, about midway between the Dunn Institute of Biochemistry and the Molteno Institute of Parasitology, where the laboratories of Sir F. Gowland Hopkins and M. Dixon and of D. Keilin, respectively, are located. While this is a tribute to the loyalty of the author whose development was so decisively influenced by these men to whom the volume is dedicated, and while some of the members of other "galaxies" revolving around this center also find mention in the exposition, there are some glaring omissions, often concerning work performed on this side of the Atlantic.

No one who has followed the rapid metamorphosis of the author from a keen, but little experienced student to a mature investigator and a recognized authority in the field, can fail to be impressed by his detached and cautious attitude towards many controversial questions. In fact, this reserve might be mistaken by some for indifference and artificial neutrality. After all, the individual facts are on record and could, although with considerable labor, be dug out from the literature. But the chief interest in such a book, at least to the fellow workers of the author, is to find out what *he* thinks of the burning issues in the field.

A few points deserve specific mention. In Table I (p. 12) one misses the inclusion of pheoporphyrin among the porphyrins important for the discussion of iron porphyrin protein enzymes; nor is the pheohemin nature of the respiratory ferment of Warburg mentioned. It is interesting to note that the author considers the identification of Warburg's ferment with the cytochrome a_3 -component of Keilin as premature. In presenting Keilin's scheme of catalase action, based on a specific reduction of the ferric form by hydrogen peroxide and a reoxidation of the ferrous form by molecular oxygen, the objections raised by other workers are not discussed. The enzyme-substrate compound character of the spectroscopically well-defined catalase-ethyl hydrogen peroxide complex is denied in a rather categorical fashion without adducing convincing evidence. In the section on peroxidase, the early formulation of Willstaetter and Heiss for the conversion of pyrogallol to purpuro-

gallin is reproduced without referring to the more recent scheme proposed by Haber and Willstaetter which postulates the intermediary production of monovalent radicals and which assumes a chain character for the process. It is stated that peroxidase is best prepared by the combined methods of Elliott and of Keilin and Elliott, representing extensions of Willstaetter's original methods and yielding preparations of a maximum activity, expressed in terms of the purpurogallin number, of P. Z. 1500; whereas Willstaetter and Pollinger, many years before, succeeded in obtaining preparations of P. Z. as high as 4900. Furthermore, it ought to be mentioned that proof for the exact position of the side chains in the peroxidase hemin is still lacking.

In the section dealing with cytochrome components and cytochrome oxidase, the work by Zeile and his collaborators and that by Theorell on the chemical structure of cytochrome *c* might have deserved a fuller discussion. The intimate association of cytochrome oxidase with "insoluble particles" is stressed, whereas recent work (*cf.* Cold Spring Harbor Symposia, 7: 312, 1939) suggests an alternate interpretation. The work by Stotz, Hastings and Hogness on cytochrome oxidase is not mentioned. The statement that the intensities of the cytochrome *a* and *a₃* bands always run parallel, is in error (*cf.* *Ann. Rev. Biochem.*, 9: 1, 1940).

In the chapter discussing pyridinoproteins, a structural formula for coenzyme II (triphosphopyridine-nucleotide) is given, postulating a bridge formed of three phosphoric acid radicals in a straight line, which has become rather improbable in view of the ready interconversion of coenzyme II into I (diphosphopyridine-nucleotide).

It might be mentioned, in passing, that the exclusive crediting of the Kuhn and Karrer schools for elucidating the structure of riboflavin and of Tauber for first synthesizing cocarboxylase is in conflict with the facts (*cf.* Theorell, *Bio. Z.*, 278: 263, 1935; *Erg. Enzymforsch.* 6: 111, 1937, with regard to the former and *Enzymologia*, 3: 82, 1937, with regard to the latter).

In a future edition, it is probable that the author will want to include the full discussion of ascorbic oxidase in the chapter dealing with copper proteins rather than in that on unclassified oxidation enzymes.

The very complex and controversial question of nomenclature is handled with skill and tact.

The excellent paper, binding and printing are in the best tradition of the Cambridge University Press and do not convey an inkling of the fact that the book was produced in a country fighting for its very existence.

KURT G. STENIN

SPECIAL ARTICLES

EGG-WHITE INJURY AS THE RESULT OF
NONABSORPTION OR INACTIVATION
OF BIOTIN¹

Egg-white injury is produced in animals fed a diet that contains a large proportion of fresh or commercial egg white and is devoid of a specific protective factor (vitamin H). The recent identification² of vitamin H with biotin made the experimental analysis of the syndrome of egg-white injury easier and less time-consuming through the use of the simple yeast growth method for quantitative determination of biotin (vitamin H). In contrast to the laborious animal assays which require a long preparatory period of from 6 to 10 weeks with a subsequent test period of 4 weeks,³ the biotin test can be performed in less than 24 hours.⁴

By the microbiological method it has been demonstrated⁵ that the tissues of chicks on a diet causing egg-white injury were deficient in biotin (vitamin H) despite the abundance of this vitamin in the diet. In continuation of these studies experimental evidence has recently been presented⁶ to show that commercial or fresh egg white is capable of inactivating biotin *in vitro*, owing probably to the formation of a fairly stable compound of biotin with a special constituent of egg white. This particular fraction of egg white in further purification has exhibited albumin-like properties. Following a proposal of the Texas group it has been tentatively called "avidalbumin" (literally, hungry albumin).

The next problem, namely, whether the biotin-binding capacity of the avidalbumin fraction may also explain its apparently "toxic" effect when it is fed to animals, has been studied in direct trials on rats.

For this special purpose there has been utilized the well-known fact that egg white loses its "toxic" properties when it is subjected to continued and intensive treatment with heat.⁷ In preliminary experiments it has been found that rats with well-developed egg-white injury improve remarkably within 2 weeks after

cooked dried egg white has been substituted for the original commercial egg white in the experimental diet.⁸ The skin clears up and growth is resumed to a considerable degree.

In the principal experiments avidalbumin concentrates have been thoroughly mixed with pulverized cooked dried egg white in an amount which corresponded, on the basis of biotin-binding capacity, to the equivalent amount of fresh egg white. For instance, in one group of experiments 231 mg of concentrate represented 100 gm of dried fresh egg white and was consequently added to 100 gm of dried cooked (inactivated) egg white. At the same time control animals were kept on a diet which without any further change contained the same proportion (30 per cent.) of cooked egg white but no added avidalbumin. Owing to slight fluctuation in purity, the concentration of avidalbumin preparation in the diet was not a constant figure but varied in the experiments between 0.03 and 0.07 per cent.

The results obtained speak unequivocally in favor of the assumption that avidalbumin has to be considered the "toxic" constituent of egg white, as it causes the specific syndrome of egg-white injury when it is included in the diet fed to rats. When the diet containing cooked (inactivated) egg white and avidalbumin was fed to rats suffering from egg-white injury during the whole of the experimental period of 2 weeks not the slightest improvement was observed. On the contrary, without exception, the condition of the rats deteriorated considerably, proving the "toxic" effect of the avidalbumin fraction. In contrast, rats fed the same diet minus avidalbumin, with or without a preceding period in which cooked egg white plus avidalbumin was fed with the regular deteriorating effect, have shown considerable improvement in 2 weeks.

SELECTED EXAMPLES

Rat No. 6096. Period I (2 weeks) with avidalbumin; loss in weight 4 gm; severe egg-white injury. Period II (2 weeks) without avidalbumin; gain in weight 32 gm; egg-white injury improved.

Rat No. 6097. Period I (2 weeks) with avidalbumin; loss in weight 11 gm; severe disease. Period II (2 weeks) without avidalbumin; gain in weight 35 gm; almost cured.

Similar results were obtained in a group of animals fed a diet that contained only two thirds of the equivalent amount of avidalbumin. This fact proves the high activity of the avidalbumin fraction.

The experiments here reported prove conclusively that the "toxicity" of egg white can be attributed to its avidalbumin fraction. On the other hand, it is known

⁸ György (3), p. 737.

¹ In this cooperative research the biotin binding protein was prepared and furnished by the Texas group, and the Cleveland group was responsible for the animal experiments.

² P. György, D. B. Melville, D. Burk and V. du Vigneaud, *SCIENCE*, 91: 243, 1940; V. du Vigneaud, D. B. Melville, P. György and C. S. Rose, *SCIENCE*, 92: 62, 1940; P. György, C. S. Rose, K. Hofmann, D. B. Melville and V. du Vigneaud, *SCIENCE*, 92: 609, 1940.

³ P. György, *Jour. Biol. Chem.*, 131: 733, 1939.

⁴ E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

⁵ R. E. Eakin, W. A. McKinley and R. J. Williams, *SCIENCE*, 92: 224, 1940.

⁶ R. E. Eakin, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.*, 136: 801, 1940.

⁷ H. T. Parsons and E. Kelly, *Am. Jour. Physiol.*, 104: 150, 1933.

that this fraction is able to neutralize biotin *in vitro* and that this action is due to the formation of a fairly stable compound. Thus egg-white injury is explained by the unavailability of biotin because of its fixation to the avidalbumin. It can be assumed that in the presence of avidalbumin biotin is not even absorbed from the intestinal tract and is excreted with the feces. This would then also throw light on the question why biotin should exert a potency three to five times higher in parenteral administration than in oral.⁹

From one point of view egg-white injury is a secondary deficiency disease and belongs in the same group as deficiency manifestations in sprue, for instance, or in other chronic diarrheic conditions. It also bears some similarity to the possible effect of long-continued medication of mineral oil on the vitamin A (carotene)¹⁰ and vitamin D¹¹ reserves of the body, with the important distinction, among others, that in contrast to avidalbumin mineral oil is not a regular food constituent.

The mechanism of egg-white injury appears to represent a hitherto unknown principle in the production of disease.¹²

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THE EXCRETION OF INJECTED HEPARIN IN THE URINE OF MICE AND DOGS

THERE is some controversy in the literature as to whether heparin is excreted in the urine following its intravenous injection. Howell and McDonald¹ and Wilander² reported that heparin is excreted by the

⁹ P. György and C. S. Rose, *Proc. Soc. Exp. Biol. and Med.*, 43: 73, 1940.

¹⁰ A. C. Curtis and P. B. Horton, *Am. Jour. Med. Sci.*, 200: 102, 1940; M. T. Burrows and W. K. Farr, *Proc. Soc. Exp. Biol. and Med.*, 24: 719, 1926-27; R. A. Dutcher, J. O. Ely and H. E. Honeywell, *Proc. Soc. Exp. Biol. and Med.*, 24: 953, 1926-27; R. A. Dutcher, P. L. Harris, E. R. Hartzler and N. B. Guerrant, *Jour. Nutrition*, 8: 269, 1934.

¹¹ M. C. Smith and H. Spector, *Jour. Nutrition*, 20: 19, 1940.

¹² Aqueous solution of tobacco mosaic virus (containing 25 mg per cubic centimeter), kindly furnished by Dr. W. M. Stanley, Rockefeller Institute, Princeton, N. J., has been tested for its biotin-binding capacity. The test showed (1) that the virus did not inactivate biotin in so far as the yeast is concerned and (2) that no appreciable amount of biotin is freed by heating the virus in solution.

¹ W. H. Howell and C. H. McDonald, *Bull. Johns Hopkins Hosp.*, 46: 365, 1930.

kidney. Jaques³ on the contrary recently reported that heparin does not appear in the urine. We, therefore, tested the urine of heparinized mice and dogs for the presence of heparin.

METHOD

According to Lison⁴ the purple color obtained with toluidine blue is specific only for sulfuric acid esters of high molecular weight. Jorpes and Bergström⁵ considered heparin to be a mucicetin polysulfuric ester and Jorpes⁶ tested this metachromatic reaction on heparin solution. He found that the color with heparin is about one hundred times more intense than with chondroitin sulfuric acid.⁷ We confirmed his observations and moreover found that the heparin of the Connaught Laboratories (110 units per mgm) was about 1,100 times more intense than chondroitin (Wilson and Company). The method is very simple: 0.5 cc of toluidine blue in distilled water 1:5000 is added to 0.5 cc of diluted or undiluted urine. If heparin is present a purple color results. A precipitate is gradually formed and after 30 minutes its density is compared with a series of standard solutions containing 1 to 6 units of heparin to the same amount of normal urine. Two hundred to 1,000 units of heparin per 20 grams weight were injected subcutaneously into 11 mice. Three to 6 hours after the injection the urine showed a purple color with toluidine blue. One hundred and 200 units of heparin per kgm of body weight were injected intravenously into 12 dogs. Samples of urine were obtained before heparinization and one hour after the heparin was injected.

RESULTS

Normal urine never showed the purple reaction whereas the urine of the heparinized animals always developed a purple color. The estimated number of units of heparin could be computed to the volume of urine obtained by catheterization. It was thus possible to measure in a certain time interval the approximate amount of heparin excreted by the kidneys. As further proof, the urine was also tested for its anticoagulant action upon blood. It was found that urine from heparinized dogs prolonged the coagulation time of blood whereas urine from the same dogs before heparinization did not.

We conclude that heparin injected subcutaneously in

² O. Wilander, *Skandinav. Arch. f. Physiol.*, 81: Suppl. xv, 1939.

³ L. B. Jaques, *Am. Jour. Physiol.*, 125: 98, 1939.

⁴ L. Lison, *Compt. rend. Soc. de biol.*, 118: 821, 1935; *Arch. de Biol.*, 46: 599, 1935; *Bull. Soc. chim. biol.*, 18: 225, 1936.

⁵ E. Jorpes and S. Bergström, *Jour. Biol. Chem.*, 118: 447, 1937.

⁶ E. Jorpes, *Acta med. Scandinav.*, 88: 427, 1936.

⁷ E. Jorpes, *Acta med. Scandinav. Suppl.*, LXXXIX: 139, 1938.

very large quantities or intravenously in moderate quantities is partly excreted by the kidneys.

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THE ARTIFICIAL SYNTHESIS OF A 42-CHROMOSOME WHEAT

COMMON wheat, *Triticum vulgare*, and the related species, *T. Spelta* and *T. compactum*, form a natural group (usually called the *vulgare* group) which is believed to have originated by crossing between a wheat of the emmer type and a species of the related genus *Aegilops*. This origin was first suggested by Percival on purely taxonomic grounds. Later it received strong support from genetical and cytological evidence.

The different species of both *Triticum* and *Aegilops* have their chromosome numbers in multiples of seven. The emmer wheats are tetraploid ($2n=28$) and the *vulgare* group hexaploid ($2n=42$). Cytogenetic studies show that all the fourteen haploid chromosomes of emmers have homologues among the twenty-one of *vulgare* and spelt. The remaining seven in the latter must, if our hypothesis of the origin of *vulgares* is correct, have come from *Aegilops*. And cytological evidence is not lacking that some species of *Aegilops* contain a set of chromosomes which are homologous with these seven.

Crossing a species of wheat which has fourteen haploid chromosomes (emmer) with one of *Aegilops* which has seven, produces a completely sterile hybrid which has twenty-one. If doubling of the chromo-

somes were to occur in the sterile hybrid, the somatic number (42) of the *vulgare* group would be produced, fertility should be restored, and, if the hypothetical origin of *vulgares* is correct, the characters might be expected to resemble those of *vulgares*.

Accordingly, *T. turgidum* ($n=14$) was crossed with *A. speltoides* ($n=7$). The seedlings were treated with colchicine to induce chromosome doubling. A special colchicine technique involving repeated daily injections with a hypodermic needle proved successful. A considerable number of heads on two different plants were found to have the doubled number. These heads with forty-two chromosomes showed nearly normal chromosome behavior (twenty-one pairs). They were fully fertile.

Several offspring from these heads have been raised to maturity. Their chromosome number is that of the *vulgare* group of wheats; their chromosome behavior is nearly regular; their fertility is reasonably good. They also have some of the characters of the *vulgare* group; this is true with respect to laxity of head, pubescence of leaves, shape of glume, shoulder and tip of glume and development of keel. In certain respects spelt resembles some of the 28-chromosome wheats more than it does *vulgare*, and in some of these points the synthetic type resembles spelt, notably in form and fragility of head and adherence of glumes. In certain other characters, such as the diameter and solidity of the stem, the new type resembles the emmers rather than either *vulgare* or spelt.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN ANTIMONY ELECTRODE FOR THE CONTINUOUS RECORDING OF THE ACIDITY OF HUMAN GASTRIC CONTENTS*

THE pH of gastric contents has been determined *in situ* by Eyerly and Brenhaus¹ for human beings and by Flexner and Kniazuk² for dogs. In both investigations the glass electrode was used. The disadvantages of using this electrode lie in the serious difficulty of adequately insulating the leads from the electrode, since the resistance of this insulation must exceed that of the glass electrode and the large size and inflexibility of the tubes that must be passed into the stomach.

³ Aided by a grant from the Dazian Foundation for Medical Research.

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¹ J. B. Eyerly and H. C. Brenhaus, *Am. Jour. Digest. Dis.*, 6: 187, 1939.

² I. Flexner and M. Kniazuk, *SCIENCE*, 90: 239, 1939.

The method for measuring the pH of gastric juice described here overcomes these difficulties by substituting for the glass electrode an especially prepared antimony electrode. No elaborate precautions are required for insulation. The electrode is 5 mm in length and 1 mm in diameter and the rubber tube containing the leads, which are 3 strands of No. 43 copper wire, is only 1 mm in diameter and entirely flexible. The electrode is swallowed without any difficulty and can be retained in the stomach for a long period of time without the slightest discomfort to the subject.

The potential of the antimony electrode is measured against a calomel half cell connected to saline in a basin into which the subject places a foot. The pH is recorded with any convenient type of measuring apparatus; for the record given here, a Leeds and Northrup continuous recording potentiometer was used.

The antimony electrode is extensively used in measuring pH in industrial processes,³ but it is rarely used in physiological investigations. It does not function satisfactorily in strongly alkaline solutions⁴ or in the presence of powerful oxidizing agents⁵ as in the blood, but these limitations are not encountered in dealing with gastric contents. The antimony electrode is less sensitive than the glass electrode,⁴ but is accurate to a change of 0.1 in pH, which is adequate for measurements on gastric contents. The greatest disadvantage of the antimony electrode has been the

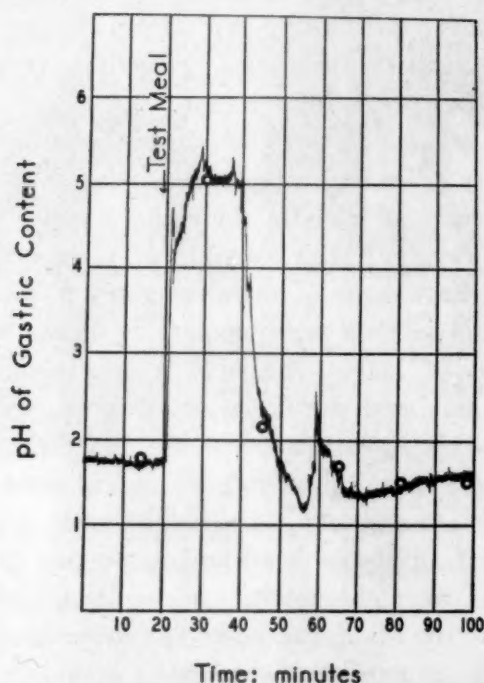


FIG. 1. Continuous record of pH of gastric contents obtained with antimony electrode before and after test meal. Dots represent values obtained with glass electrode on gastric contents withdrawn with Levin tube.

tendency for its current to drift and thus yield erratic and erroneous values.^{6,7} Many attempts have been made to overcome this defect by obtaining a surface coating of stable oxides.⁵ We have succeeded in preparing an electrode which is stable in gastric contents by treating the metal with bromine water.

In preparation for use, the electrode is polished with fine emery paper and immersed for 30 minutes in a 1 per cent. solution of bromine in water; it is then washed in water and dried with a soft cloth but is not polished. At intervals of approximately one week during daily use, the electrode is polished with emery paper and treated with bromine water as de-

scribed. The electrode thus prepared responds to change in pH within the range 1.0 to 7.0 without appreciable lag and without drift.

There is no danger of any toxic action from the antimony when the electrode is swallowed. None of the subjects, in whose stomach the electrode was retained for several hours each day for nearly a month, complained of any disturbance. As further proof, an electrode was carefully weighed and placed in $n/10$ HCl; after 24 hours of immersion the loss of weight was 0.2 mg; and after 48 hours, 0.3 mg.

The electrode does not function satisfactorily for one to two hours after a full-sized meal, presumably because it may become embedded in large masses of food. This difficulty is not encountered with any of the ordinary test meals used for clinical purposes.

Fig. 1 shows a tracing from a typical record of the pH of the gastric contents before and after a test meal. In this experiment a Levin tube was also passed into the stomach and specimens of the contents withdrawn; the pH of these specimens was determined in the usual manner with the glass electrode; the values obtained are shown as dots in Fig. 1. The agreement between the values found is within pH 0.15. In the record shown here the pH of the gastric contents reached a minimum value 36 minutes after the test meal was given. An abrupt but brief rise in pH then occurred. This momentary rise is characteristic of many records we have obtained.

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BOOKS RECEIVED

- COULSON, C. A. *Waves; a Mathematical Account of the Common Types of Wave Motion*. Pp. xii + 156. 29 figures. Interscience. \$1.50.
- DURAND, DAVID. *Studies in Consumer Instalment Financing, No. 8: Risk Elements in Consumer Instalment Financing*. Pp. xx + 163. 5 figures. National Bureau of Economic Research, New York.
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